Visibility of Technology and Cumulative Innovation: Evidence from Trade Secrets Laws

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Slides: `https://bganglmair.github.io/secrets-slides.pdf`

Which types of inventions are kept secret?

What is disclosed through patents?

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What is disclosed through patents?

Is too much trade secrecy bad for welfare?

Is too much protection of trade secrets bad for welfare?

UNITED STATES PATENT OFFICE.

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MACHINE FOR CUTTING THE FRONTS AND BACKS OF VIOLINS.

Specification of Letters Patent No. 13,878, dated December 4, 1855.

Patented Feb. 12, 1924. 1,483,733

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LOUIS KOZELEK, OF SCHENECTADY, NEW YORK.

PROCESS OF TREATING WOOD FOR THE MANUFACTURE OF MUSICAL INSTRUMENTS.

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- Only what is patentable
- Exclusive rights
- 20 years from date of filing

Trade secrets

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- Anything of potential value
- No exclusivity
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- **Protects against unlicensed use**
- **Disclosure**

Trade secrets

- Traditionally state law (U.S.)
- Anything of potential value
- No exclusivity
- Potentially indefinite
- **Protects against misappropriation**
- **Secrecy**

What is a Trade Secret? Legal Protection?

- Any information a firm produces or collects and keeps to itself
  - Your secret BBQ sauce
  - Customer list
  - Edison's "10,000 ways that won't work"
  - Specification of a machine or a production process
- Aspects of legal protection:
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Protection stemming from trade secrets ($\tau \in [0, 1]$) is weaker than from patents ($=1$)

The Trade-Off: Stronger Protection of Trade Secrets . . .

higher ex-ante R&D incentives
with more potential for follow-on innovation

vs.

less disclosure of (non-self disclosing) inventions
and larger deadweight loss (from trade secrets)

Three-Stage R&D Model

Stage 1: Ex ante R&D decision

- Weigh cost of R&D of *potential invention* against expected payoff

→ *realized inventions*

Stage 2: Disclosure/patent or secrecy?

- Can I enforce the patent?
- Can I "enforce" secrecy?

Stage 3: Follow-on Innovation

- Probability of follow-on innovation
  - How strong are barriers to access?
  - How much of the invention is *visible*?

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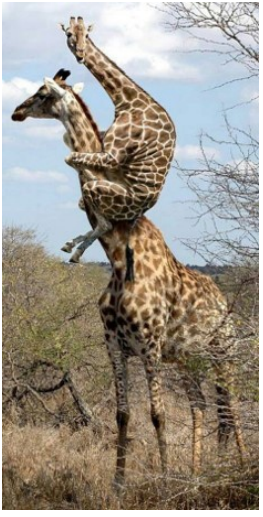

Do you see?

Visibility: Vital for Patent Monitoring — Fatal for Secrecy

> "A patent claim whose infringement is very hard to discover is a claim with low or no value." (Goldstein 2013)

- Strandburg (2004): "Self-disclosing inventions"
- Visibility difficult to measure, but:

processes on average less visible than products

Approach

- **Step 1:** Does stronger trade secrets protection affect what is disclosed?
  - Reduced form estimates: less disclosure of less visible inventions
  - Data: U.S. utility *patents* (process or product) and *trade secrets protection index* (Png 2017)

Approach

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- **Step 3:** Develop a structural model
  1. Using size of causal effect from Step 1: estimate distributions (types and type-specific visibilities) of **realized inventions**
  2. For given R&D costs, recover distributions of **potential inventions**

Trade Secrets Protection: Uniform Trade Secrets Act

- Exogenous variation in **trade secrets protection** through UTSA
  - Published by Nat'l Conference of Commissions on Uniform State Laws
  - States voluntarily adopt *template* to change from common law to UTSA
- Harmonize and clarify state trade secrets laws:
  - *definition* (information in use?)
  - *misappropriation*
  - *remedies* (e.g., damages multiplier)
- *Examples:* Virginia dropped use requirement and increased punitive damages multiplier from 0.5 to 2
- Trade secrets protection index by Png (2017):
  - Measures U.S. state-year level strength of trade secrets protection with changes around state-wise adoption

Step 1:

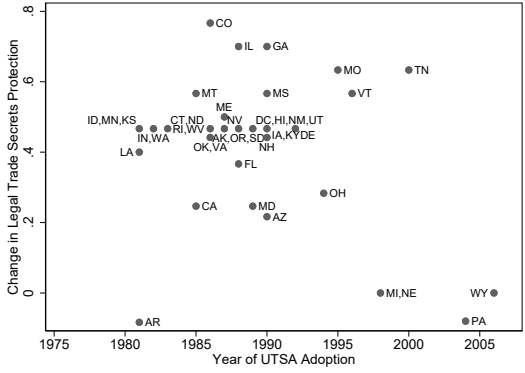
Does stronger trade secrets protection affect what is disclosed?

Theoretical prediction:

The share of process patents is decreasing as trade secrets protection increases

Empirical Strategy

- We exploit the staggered adoption of the UTSA in a diff-in-diff setting
- Dependent variable:
  patent type (process or product)
- Independent variable of interest:
  trade secrets protection index

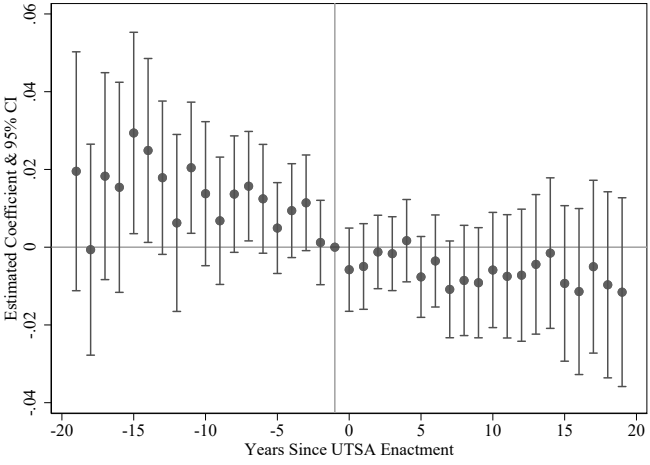


[I] Stronger TS $\rightarrow$ Less Disclosure of What's Likely Hidden

Dep. variable: =1 if process patent	(1)	(2)	(3)	(4)	(5)
Trade secrets protection	-0.018***	-0.021***	-0.026***	-0.026***	-0.018***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)
Patent complexity controls	N	Y	N	Y	Y
Patent value controls	N	N	Y	Y	Y
State FE, year FE	Y	Y	Y	Y	N
USPC Mainclass FE	Y	Y	Y	Y	N
State/Year $\times$ USPC Mainclass FE	N	N	N	N	Y
Observations	1,451,307	1,451,307	894,956	894,956	892,296
$\overline{R^2}$	0.297	0.342	0.288	0.335	0.357

- UTSA leads to **mean decrease** of **2.2%** (Col. (4) and **1.5%** (Col. (5)) of the probability that a patent is a process patent

Timing of the Effect



- No obvious pre-trends in probability that patent includes a process
- Coefficients suggest an immediate and lasting negative effect of the UTSA

[I] Applicant Size and Technology Type

	Applicant size		Technology type	
	(1)	(2)	(3)	(4)
Trade Secrets Protection				
... × Individual	-0.047***	-0.034***		
... × Small firm	-0.021**	-0.006		
... × Large firm	-0.013	-0.011*		
... × Discrete technology			-0.064***	-0.038***
... × Complex technology			-0.008	-0.007
State FE, Year FE	Yes	No	Yes	No
USPC Mainclass FE	Yes	No	Yes	No
State/Year × USPC Mainclass FE	No	Yes	No	Yes
$\overline{R^2}$	0.336	0.358	0.334	0.356
Observations	894,956	892,296	855,654	852,923

Robustness

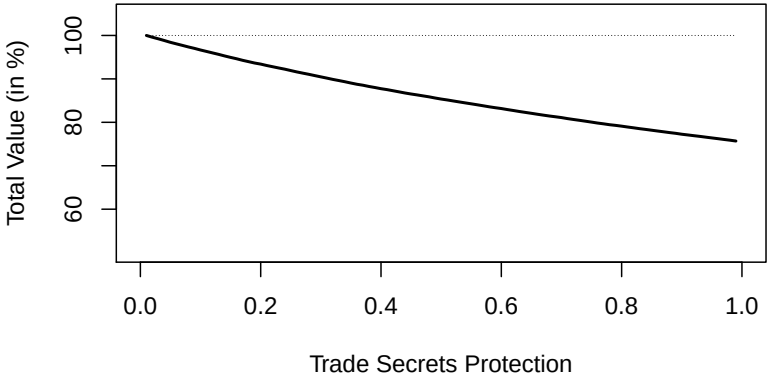
Instrument for UTSA using other uniform laws	Placebo tests (adoption *t* years earlier)	State-specific time trends
Patent application date as decision timing	First applicant location	No software patents
Patent family head (parent patent)	Single applicant	Alternative process patents (first claim, majority)

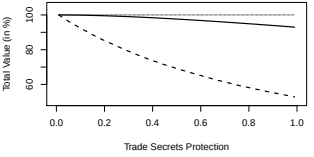
Step 2:

How does reduction of disclosure of what is less visible affect follow-on innovation and overall value?

Model calibration with uniformly distributed visibilities

[II] No R&D Costs: Negative Effect





- Stronger protection has a negative effect on welfare

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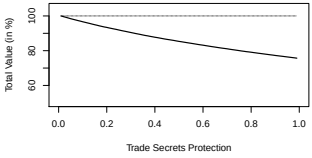
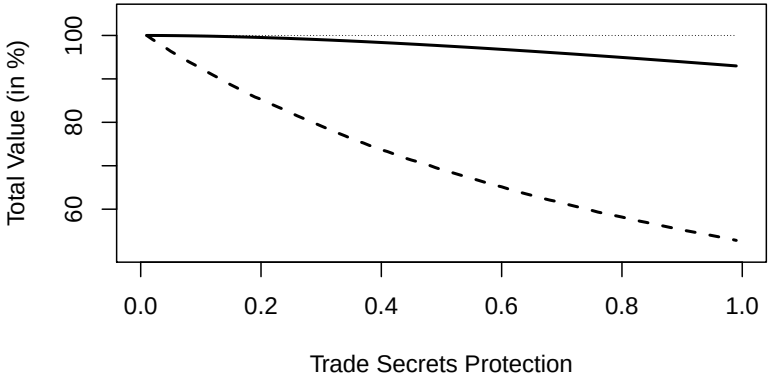
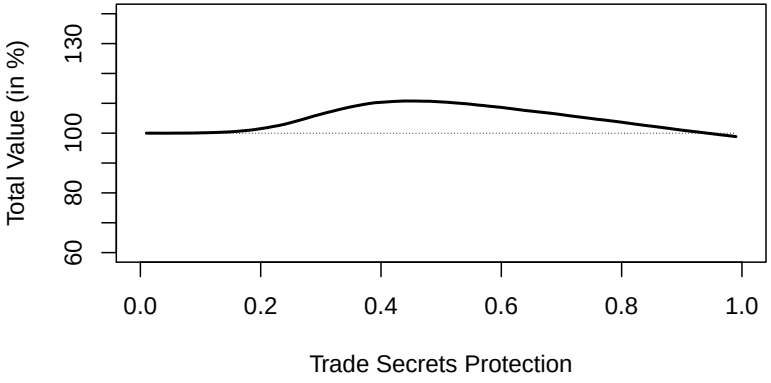
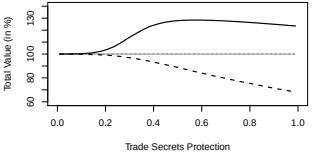




- Less follow-on innovation (**dashed**) because less is disclosed
- Ex ante incentives are ineffective – only a negative DWL-effect (**solid**)

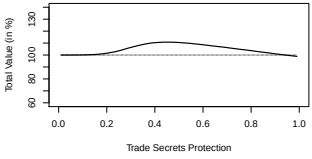
[II] Higher R&D Costs: Maybe Positive Effect

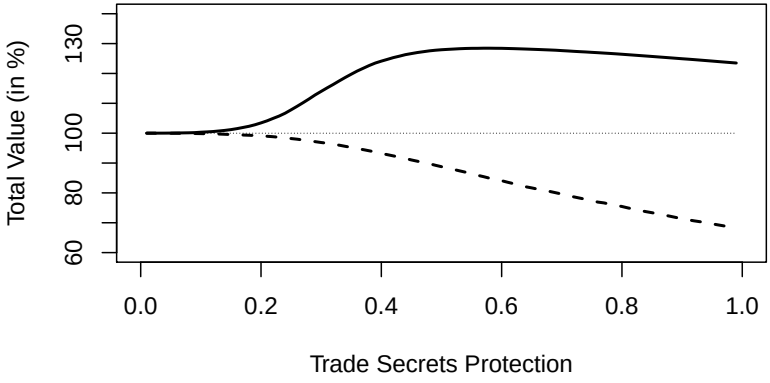




- Stronger protection can have a positive overall welfare effect

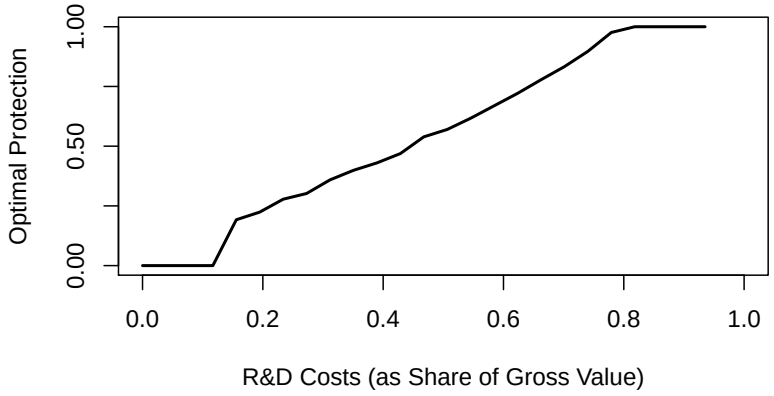
[II] Higher R&D Costs: Maybe Positive Effect





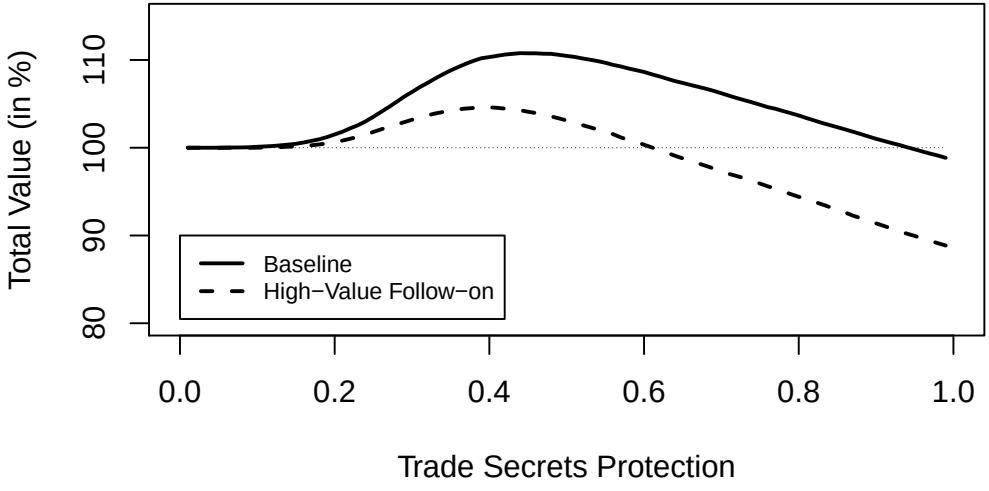
- Negative effect on follow-on innovation prevails (**dashed**)
- Ex ante incentives more than offset the negative DWL-effects (**solid**)

[II] Optimal Protection Increases as R&D Costs Increase



- Optimal trade secrets protection depends on costs of R&D
- Trade secrets protection should be stronger for higher costs
- Rationalizes, e.g., (non-UTSA) trade secrets protection in N.Y.

[III] Lower Optimal Protection With High-Value Follow-On



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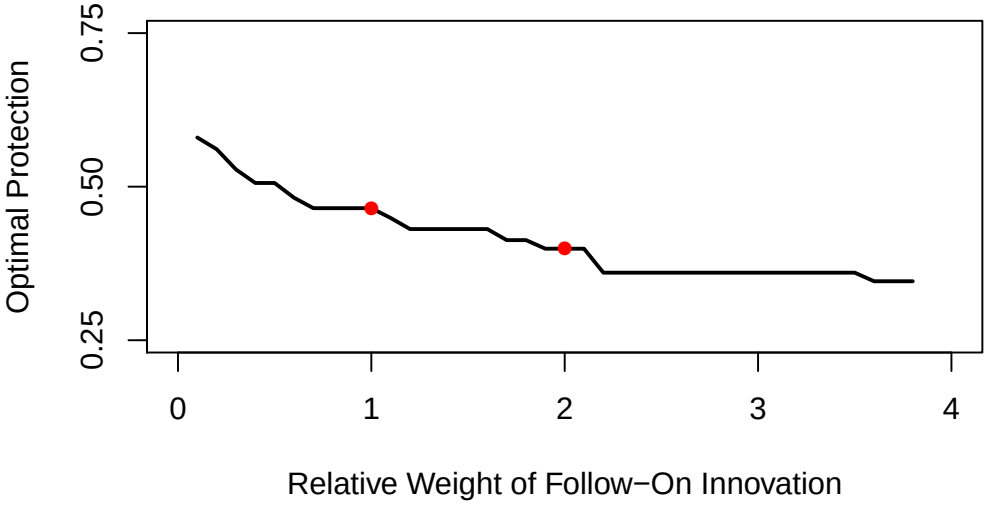


Step 3:

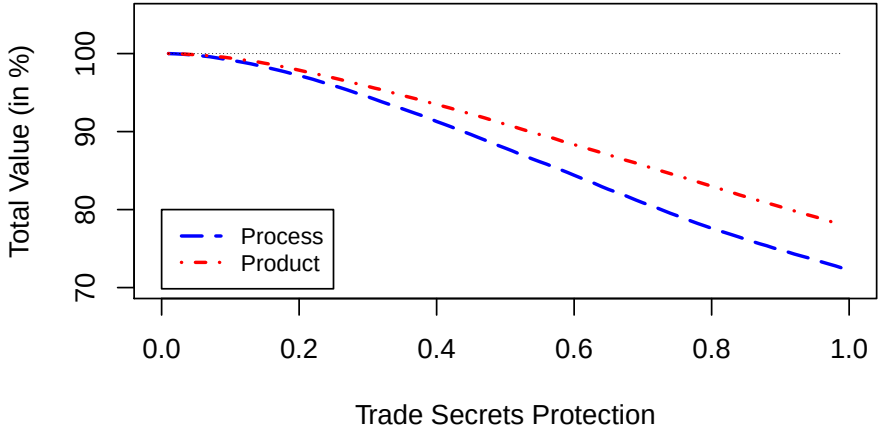
Patent types (process or product) as vehicles to proxy visibility:

How do the welfare effects differ for different invention types?

Structural model to recover type-specific distributions for visibilities

[IV] Stronger Results for Processes – In Both Directions

- **Low costs:** Trade secrets protection is more damaging in process intensive industries

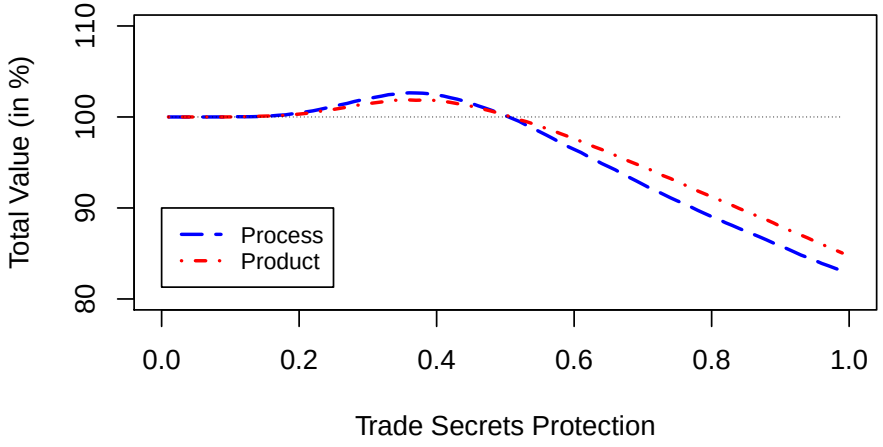


[IV] Stronger Results for Processes – In Both Directions

- **High costs:** Trade secrets protection is more value-enhancing in process intensive industries

[IV] Stronger Results for Processes – In Both Directions

- Effect of trade secrets protection more pronounced for processes than for products (here: medium costs)



Summary

- Visibility matters for patenting-vs-secrecy
- Trade secrets matter for patenting-vs-secrecy

  $\Rightarrow$ both matter for disclosure and follow-on innovation
- add costs $\Rightarrow$ non-trivial effect of trade secrets on welfare

Bad for welfare? Depends on R&D costs!

Does It Matter?

- Secrecy is an important tool in an IP manager's toolkit
- Numerous surveys find that secrecy is at the top of the list of means of IP protection; patents rank 3rd/4th
- Understudied problem (data!) but timely and relevant
  - U.S.: Defend Trade Secrets Act of 2016
  - EU: Trade Secrets Directive 2016/943
- We need more research on secrecy and trade secrets

Thank you!

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